SIMULATION OF SHAPED DUCTILE FIBER PULLOUT USING A MIXED COHESION AND FRICTION MODEL

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Shaped ductile fibers have been shown to greatly improve fracture toughness of short fiber composites [4, 3, 5]. However, the nature of the optimal shape and effect of their distribution remain important open questions. In this talk we report on numerical simulations of quasi-steady fiber pullouts designed to address these questions. For single fiber pullouts we assume an axisymmetric representative volume element. A mixed interfacial model including both cohesive and frictional effects is developed to capture the propagation of debonding and stress distributions in the fiber and matrix. Cohesion effects are estimated based on a polynomial interface constitutive equation [1, 2].

The numerical model is first applied to a copper/epoxy RVE with small embedment length, so the effects of plasticity of the ductile fiber can be neglected. Through comparison with experimental load-displacement pullout curve, some parameters, which define the interface properties of copper/epoxy mechanism, are determined. The numerical model is then further modified by including the plastic deformation of ductile fiber, so the interaction between nonlinear interface model and overall material property can be investigated. Numerical errors are controlled using an adaptive hp version of the finite element method.

References

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